A Second Hawaiian Species of *Alectryon* (Sapindaceae): Hawaiian Plant Studies 17[1]

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THE GENUS *Alectryon* has been known in the Hawaiian Islands by a single species, *A. macrococcus* Radlk. It was first collected by Hillebrand, but, though he found it on two different islands, Molokai and Oahu, he never succeeded in assembling complete material. The binomial was published in 1890, based solely on Hillebrand's incomplete collections and data. Since that time, successive botanists, Rock, Forbes, Degener, and others, have found new localities for the species; it is now known on Kauai, Oahu, Molokai, and Maui. Nevertheless, *Alectryon* is still considered a rare tree. On Kauai it was discovered by Gay, and by Lydgate in Olokele Valley, apparently early in the 20th century, but it has not been found there since. On Molokai it is apparently extinct at the type locality, though Degener found another station only a mile or two away at Puu Makaliilii, where in 1928 there were two dying trees. On Maui it was known from the rich, dry forest at Auahi on Haleakala, where Rock in 1910 found 40 trees. Since Rock's time this rich area has been deforested by cattle grazing. Another station was found by Forbes in Olowalu Valley, west Maui, in 1920, but no one has found *Alectryon* there since. On Oahu it is now known to extend, in the Waianae Mountains, from Pahole Gulch to Ekahanui Gulch, or nearly the full length of that mountain range. Yet, even on Oahu, the trees are few and remote and the discovery of one is a noteworthy event on a day's exploration. Most unusual is the large single or double fruit with its woody pericarp and abundant, juicy, scarlet, edible aril, somewhat resembling those of the related "litchi."

It is now evident that the genus contains more than one Hawaiian species and that the original *Alectryon macrococcus* was described from material assembled from two islands and representing two species. To straighten out this confusion it has been necessary to select a lectotype for the older species and describe the other as a new species.

SAPINDACEAE

Alectryon (§Mahoe) Mahoe St. John & Frederick, sp. nov.

Figs. 1, 2.

Diagnosis Typi: Arbor 7 m. alta, ramis fusci-rubri-brunneis, glabratis, cicatricibus 4.5–6 mm. latis scutiformibus pallide brunneis fasciculis 3, ramulis foliosis 4–6 mm. diametro teretibus adpressi-puberulis, internodis 5–35 mm. longis, foliis 27–42 cm. longis pari-pinnatis, petiolis 6–12 cm. longis adpressi-puberulis, foliolis 2-3-jugis, petiolulis 8–15 mm. longis basi inflata adpressi-puberulis, foliolis 10.5–21 cm. longis 5–10 cm. latis, plerumque ellipticis vel minime lanceo- vel oblanceo-ellipticis rare ovalibus plerumque plusminusve asymmetricibus, apice obtusi, basi rotundata vel abrupte subcuneata, laminis rigide crasse chartaceis fusci-viridibus glabris margine integri plani vel undulati, infra pagina intervallis glabris nervis salientibus adpressi-puberulentis, venulis saliente reticulatis,

[1] This is the seventeenth of a series of papers designed to present descriptions, revisions, and records of Hawaiian plants. The preceding papers have been published in *Bernice P. Bishop Mus., Occas. Papers* 10(4), 1933; 10(12), 1934; 11(14), 1935; 12(8), 1936; 14(8), 1938; 15(1), 1939; 15(2), 1939; 15(22), 1940; 15(28), 1940; 17(12), 1943; *Calif. Acad. Sci., Proc.* IV, 25(16), 1946; *Torrey Bot. Club, Bul.* 72: 22–30, 1945; *Lloydia* 7: 265–274, 1944; *Pacific Sci.* 1: 5–20, 1947; *Brittonia* 6(4): 431–449, 1949; *Gray Herb. Contrib.* 165: 39–42, pl. 3, 1947.

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venis lateralibus principalibus alternatis uno latere 10–12 arcuati-adscendentibus angulo 120°–145° apicibus venarum juxta margine arcuati-connatis, inflorescentibus axillaribus 9–30 cm. longis, 6–16 cm. latis adpressi-puberulentis, pedunculis 0–52 mm. longis, paniculis conicis, pedicellis 0.5–3 mm. longis, bracteis 1–2 mm. longis subulatis caduceis; floribus evidenter polygamis, specimina typica solo cum floribus hermaphroditis, calycibus 2 mm. altis 2–2.5 mm. diametro valvatis patelliformibus basi truncata dense adpressi-sericeo-puberulentis, lobis 5 inaequalibus anguste deltoideis loba maxima tubam subaequantibus, petalis nullis, staminibus 6–8 intra disci marginem circa pistillum insertis, filamentis 0.4 mm. longis subulatis puberulis, antheris 1.1–1.3 mm. longis elliptici-oblongis 4-locularibus 4-lobatis rubescentibus vel flavescentibus, pistillo 2-loculare basi urceolata e latere evidente compressi exserti dense breve sericeo, stylo gracile circa 0.5 mm. longo, stigmatibus 2 liguliformibus 1 mm. longis rectis deinde recurvatis, fructibus tarde irregulariter diruptis, loculis fructicis 1–2, specimina typica cum fruticibus 1-locularibus 25–38 mm. longis subglobosis laevibus fusci-brunneis, pericarpio duro lignoso pallido in basi 5 mm. crassa in apice 3 mm. crassa, arillo carnoso in stato postmaturo contracto et in apice seminis coronato, semine uno 19 mm. lato 12 mm. alto in apice proximi scutiformi concavi ossei lucide fusci-brunnei, testa lucida coccinea, apice distali rigide spinosi.

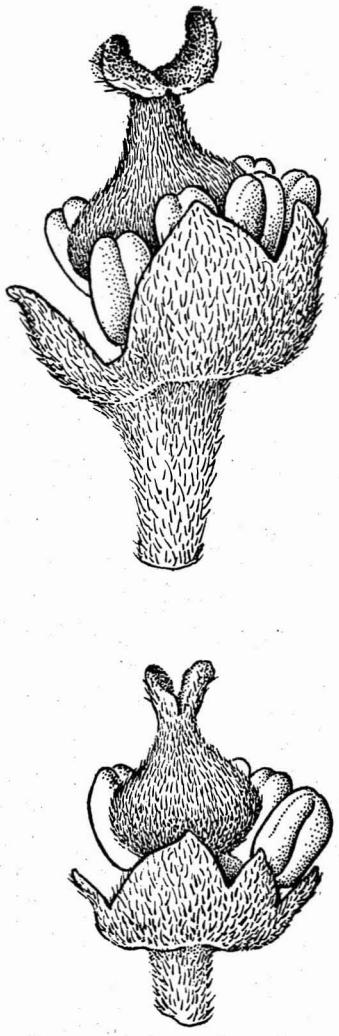

FIG. 1. *Alectryon Mahoe:* older and younger flowers of type, *Frederick & Sakimura 185,* × 10.

Description of All Specimens Seen: Tree 7–10.5 m. tall; branches dark reddish-brown, glabrate, in age the bark pale yellowish-brown, black-spotted; leaf scars 3–6 mm. wide, rounded shield-shaped, pale brown, bundle scars 3; leafy branchlets 4–6 mm. in diameter, terete, appressed puberulous; internodes 5–35 mm. long; leaves 23–54 cm. long, even pinnate; petioles 4.5–18 cm. long, appressed puberulous; leaflets in (1-)-2-3 pairs; petiolules 8–22 mm. long, swollen at base, appressed puberulous; leaflets 9–26 cm. long, 5–11.7 cm. wide, commonly elliptic or slightly lance- or oblance-elliptic, rarely oval, usually somewhat asymmetric, apex obtuse, base rounded or abruptly subcuneate, blade stiff thick chartaceous, dark green, glabrous, margin entire, plane or undulate, lower surface with intervals glabrous, with rib and veins prominent and appressed puberulent, the veinlets raised reticulate, primary lateral veins alternate, 10–17 on a side, arcuate ascending at 120°–145°, inarching and connected near the margin; inflorescences axillary, 9–30 cm. long, 6–16 cm. wide, appressed puberulent; peduncle 0–52 mm. long; panicle

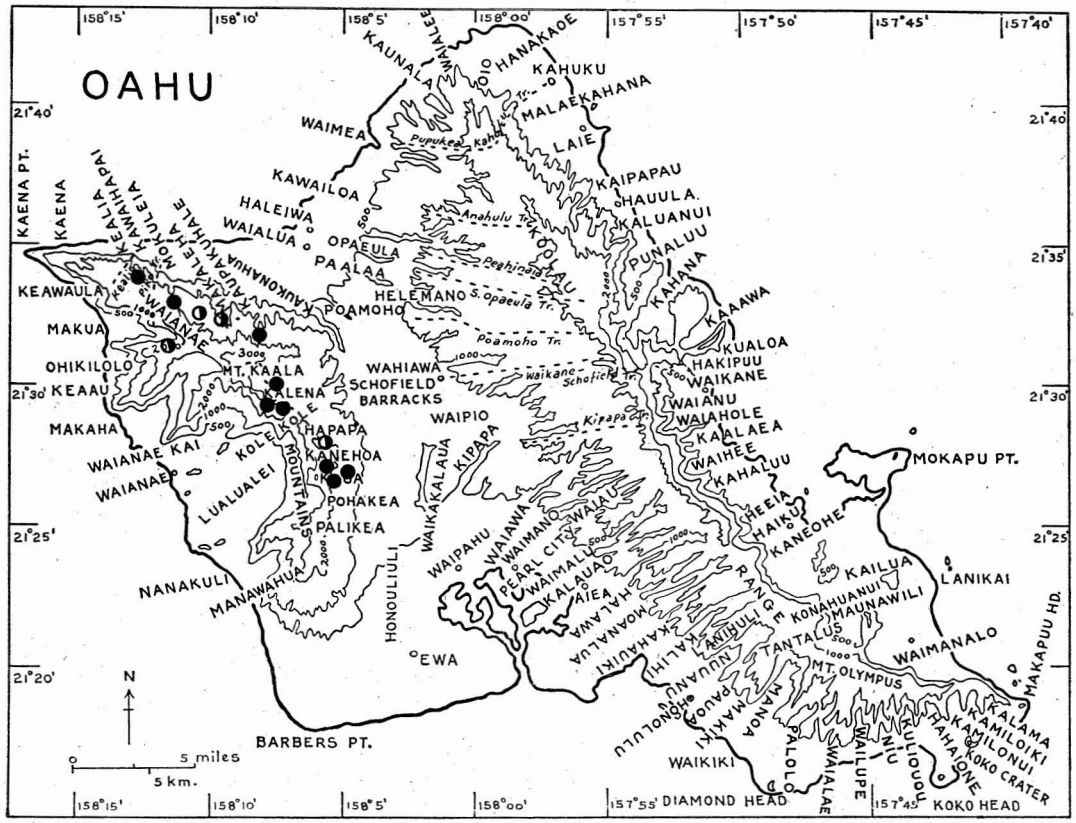

FIG. 2. Distribution of *Alectryon Mahoe*. Solid dots mark localities for specimens with exact data; half-black dots, the probable localities for specimens with incomplete data.

conical, pedicels 0.5–3 mm. long; bracts 1–2 mm. long, subulate, caducous; flowers probably polygamous; but type tree bearing only perfect flowers, these with calyx 2 mm. high, 2–2.5 mm. wide, patelliform, the base truncate, valvate, finely appressed sericeous-puberulent, lobes 5, very unequal, narrowly deltoid, the largest about equaling the tube in length, within the tube attached to an annular disk; petals none; stamens 6–8, inserted on disk at base of pistil; filaments 0.4 mm. long, subulate, puberulous; anthers when dry 1.1–1.3 (when fresh, –1.5) mm. long, elliptic-oblong, 4-lobed, 4-celled, reddish or yellowish; pistil 2-celled, the base urceolate, well exserted, densely short sericeous; ovary distinctly flattened perpendicular to the septum, tapering into a slender style about 0.5 mm. long; stigmas 2, strap-shaped, 1 mm. long, erect, later recurving; the staminate flowers with calyx 1.5–1.8 mm. high, 2.6–3 mm. wide, kneepan-shaped, finely appressed, short sericeous, slightly asymmetric and unequally 5-lobed, the lobes from half as long to nearly as long as the tube; stamens 9–13, filaments 0.2 mm. long, filiform; anthers 1.1–1.3 mm. long, oblong; pistillode 1 mm. long, broadly ovoid, densely sericeous; the fruit tardily irregularly rupturing, either maturing only one cell with a remnant of the partially developed second cell fused to it or maturing both cells and appearing like twin balls; single-celled fruit 25–43 mm. long, subglobose, smooth, dark brown; 2-celled fruit 30–47 mm. long, 40–70 mm. wide; pericarp hard woody, pale, at base

5–10 mm. thick, at apex 2–3 mm. thick; aril fleshy, scarlet, edible, "resembling peach in flavor" (*fide* Degener), shrivelling to a crown on the distal end of the single seed; seed 19–30 mm. wide, 9–12 mm. high, at hilum or proximal end shield-shaped, concave, hard and polished, dark brown, the testa scarlet, shiny, the distal end bearing the aril is produced into short spine-like processes.

Type: Hawaiian Islands, Oahu: Puu Kanehoa, South Huliwai Gulch, 2,100 ft. elev.; in open forest with *Neraudia* sp., *Fagara semiarticulata,* and *Planchonella* sp.; tree 30 ft. tall, 6 in. in diameter; Aug. 21, 1947, *L. Frederick & K. Sakimura 185* (fl. fr.) (Bishop Mus.).

Specimens Examined (the list of specimens is arranged in geographical order from north to south; abbreviations—b.=bud; fl.=flower, fr.=fruit): Oahu, Waianae Mountains: Makua Valley, southeast corner, on moderately dry forested slope, Sept. 27, 1932, *O. Degener & C. Judd 9538* (fr.); Mokuleia Trail, alt. 2,100 ft., tree 22 ft. tall, 4 in. in diameter, open forest, July 13, 1947, *L. Frederick 183* (b.); Mokuleia, near head of right branch of Pahole (Kukuiula) Gulch, moist forest, alt. 550 m., April 12, 1936, *F. R. Fosberg 13069* (fr.); Mokuleia, left branch, slopes of Kaala, April 26–May 16, 1912, *C. N. Forbes 1768-O* (fr.); Makaleha Valley, west side of, dense forest near stream, first discovery of staminate flowers, July 21, 1935, *O. Degener et al. 10906* (fl.); Makaleha (or "pali of Kalaupapa, Molokai"—but this a confusion of data), *W. Hillebrand & J. M. Lydgate;* Kamokukui Valley (between Puuiki and Puu Kamaohanui), large forest tree, April 12, 1933, *O. Degener 9535* (fr.); Mt. Kaala, base of, near end of Schofield Fire-Break Trail, dense wet forest, 4 trees seen up to 35 ft. high, March 13, 1932, *O. Degener et al. 9537;* Puu Kaala, Waianaeuka, wooded gulch, 2,000 ft. alt., tree, Jan. 8, 1933, *H. St. John & J. Dunn 12920;* Puu Kalena valley S. of E. ridge of, moist forest, alt. 750 m., tree 7 m. tall, March 22, 1936, *F. R. Fosberg 12987* (fr.); Puu Kumakalii, northeast slope of, forest, April 1, 1936, *O. Degener 11111;* Kanehoa, Honouliuli, el. 700 m., tree, 7 m. in height, steep north slope, Oct. 25, 1927, *C. S. Judd 66* (fl.); Kanehoa, Oct. 1929, *G. W. Russ* (b. fr.); Ekahanui, rich forest, April 21, 1936, *O. Degener & M. Martinez 11108* (b.), *11109* (b.); South Fork of Ekahanui Gulch, Puu Kaua, Honouliuli, 2,300 ft. alt., wooded ridge, young tree 4 m. × 5 cm., Feb. 27, 1938, *H. St. John 18684* (fr.); Ekahanui Gulch, Fire-Break Trail, Puu Kaua, Honouliuli, 1,760 ft. alt., lower forest remnant, tree 6 m. × 8 cm., Feb. 29, 1948, *H. St. John 23356* (fr.).

Waianae Range, without data: *O. Degener* (fr.).

There was also a collection from second gulch E. of Puu Kaupakuhale, N.E. slope of Puu Kaala, Mokuleia, Oct. 23, 1932, *St. John & Fosberg 12144* (fr.), but this specimen cannot now be located.

The published record (Hosaka, 1937: 224) of this tree from Kipapa Gulch is the only record for the Koolau Range. This rests only on a field observation, as the single large tree was never seen in flowering or fruiting condition.

Although there are numerous collections of this new species, most of them show only fruit or flower. The collection *Frederick & Sakimura 185* is chosen as the type because it has foliage, numerous flowers, and three good fruits, all taken from a single tree.

The new species, *A. Mahoe,* is being separated from *A. macrococcus* Radlk. which was based on the material collected by Hillebrand and on the description of his probable new genus, *Mahoe.* Hillebrand had made a collection on the "pali of Koolaupapa" [precipice of Kalaupapa], Molokai, consisting of leaves with old fruit of the previous year; and he had another collection, with leaves only, from Makaleha Valley, Oahu. Lacking flowers and complete material, he conservatively put a question mark beside his new generic name and refrained from publishing a specific name. Having only this same incomplete material, Radlkofer gave it a specific

name and placed it in *Alectryon.* His description is very brief, mentioning only that the large, usually 1-celled fruit is 3 cm. in diameter; the leaflets up to 26 cm. in length, 11 cm. wide; and that the hypodermis of the lower leaf surface is distinctive. Though these few characters could have been selected from the lengthy description given by Hillebrand, it is certain that Radlkofer studied the Hillebrand specimens in Berlin, for the Hillebrand sheet with a leaf and old fruiting branches, labeled "Mahoe, pali of Koolaupapa, Molokai." bore the note in Radlkofer's writing, "*Alectryon macrococcus* m. [ihi] Radlk." We now designate this Hillebrand sheet in the Berlin Herbarium as the lectotype of *A. macrococcus* Radlk. It was probably destroyed in the bombing of Berlin in 1943, but Figure 3 shows the sheet as it appeared when photographed by St. John in 1935.

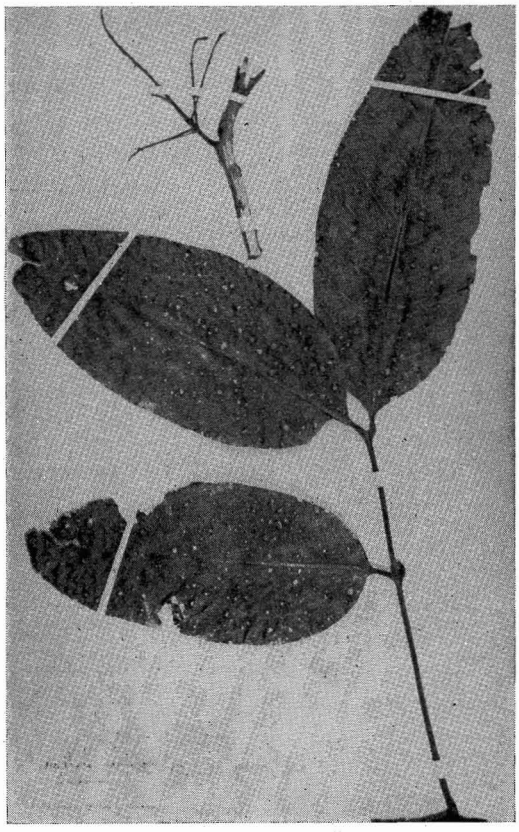

FIG. 3. *Alectryon macrococcus:* photo of lectotype in Berlin Herbarium, "pali of Koolaupapa," Molokai, Hillebrand.

FIG. 4. *Alectryon macrococcus:* flower, Haleakala, Maui, 2,600 ft., J. F. Rock, Nov. 1910, × 10.

A. macrococcus Radlk. of Molokai is distinguished by having the leaflets 11–18.5 cm. long, lance-elliptic, densely soft yellowish pilosulous below; perfect flowers with the calyx campanulate (Fig. 4); style scarcely evident; the stigmas short, erect, not diverging. The collections from Maui are very similar and are confirmed as conspecific with the true *A. macrococcus* of Molokai, and they furnish perfect flowers, with anthers only 0.5 mm. long.

In contrast, we find that *A. Mahoe* has the leaflets 9–26 cm. long, commonly elliptic (or slightly lance- or oblance-elliptic, rarely oval), except for the main veins the lower surface glabrous; perfect flowers with the calyx kneepan-shaped, the base truncate (Fig. 1); anthers 1.1–1.5 mm. long; style slender, evident. These differences seem sufficient to justify the separation of the Oahu plant as a new species. Its specific name is the Hawaiian vernacular one, "mahoe," meaning twins, in allusion to the often twinned fruit.

The illustration by Degener in his *Flora Hawaiiensis* of material which he called *A. macrococcus* from Makua, Oahu, is a good representation of fruiting *A. Mahoe,* but his description is a composite of the two Hawaiian species.

There are in the Bishop Museum two sheets of a collection from the island of Kauai: Olokele Valley, J. M. Lydgate, with stems, leaves, and a

single 1-celled fruit. This seems very like *A. Mahoe* of Oahu, but until more complete material is available, it seems unwise to assign it definitely to a species.

Radlkofer in his monograph of the genus (1933: 983) states that the flowers of the genus are falsely polygamous, that is, are male or female, often in the same inflorescence, and that they are falsely stated to be in part perfect. *A. Mahoe* has numerous examples of trees with all perfect flowers, and one example with all staminate flowers, so the generic description should now be altered to allow male, female, or perfect flowers.

A summary of the synonymy of the only other Hawaiian species is as follows:

Alectryon macrococcus Radlk., K. Bayer. Akad. Wiss., Math.-Phys. Kl., Sitzber. 20(1): 255, 1890 (as to Molokai plant); *Mahoe* ? sp., Hillebrand, Fl. Haw. Is. 86–87, 1888 (as to Molokai plant); *A. macrococcus* Radlk., Radlk. & Rock, Hawaii Bd. Commrs. Agr. and Forestry, Div. Forestry, Bot. Bul. 1: 3–4, pl. 1, 1911 (as to Molokai and Maui plants, the plate being of the Maui plant); Rock, Hawaii Bd. Commrs. Agr. and Forestry, Rept. for 1910: 81, pl. 19, 1911; Rock, Ind. Trees Haw. Is. 277–278, pl. 107–108, 1913 (as to Molokai and Maui plants); Radlkofer, in Engler, Pflanzenreich IV, 165(5): 987–988, 1933 (as to Molokai and Maui plants); Degener, Fl. Haw., fam. 210, text 5/5/'37 (as to Molokai and Maui plants; not as to the Oahu plants or the figure based on a plant from Oahu). *Dodonaea* sp., Drake del Castillo, Ill. Fl. Ins. Mar. Pacif. 6: 144, 1890, in notes under *Dodonaea viscosa,* which is his disposition of *Mahoe* of Hbd.

The generic name was first published in 1788 by Gaertner, with the single species *Alectryon excelsum,* thus indicating that he considered the name to be neuter. Other authors accepted this gender until it was changed to masculine by the monographer Radlkofer (1890: 256). Our present International Rules (Amsterdam) validate this treatment, the choice and adoption of one of the two classic genders, under Art. C.72 (1). The Greek word, *alectruon,* cock, or hen, is masculine or feminine. Gaertner said the fruit was compressed above like a comb—that is, a cock's comb. Hence, Radlkofer, using this indication, adopted the genus as a masculine one, changed the older specific names to masculine, and made all his new specific names masculine. This discussion of the gender is included as various contemporary botanists still retain the generic name as a neuter one.

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RADLKOFER, L. 1890. Ueber die Gliederung der Familie der Sapindaceen. *K. Bayer. Akad. Wiss., Math.-Phys. Kl., Sitzber.* 20(1): 105–379.

——— 1933. Sapindaceae, in Engler, A., *Das Pflanzenreich IV,* 165: 1–1002. Wilhelm Engelmann, Leipzig, 1931–1934. [Part 5, containing the genus *Alectryon,* is dated 1933.]